

REMARKS

Applicants have reviewed the non-final Office Action dated October 02, 2000, from the United States Patent and Trademark Office in the above-identified application.

Applicants respectfully submit the above amendments to claims 1, 3, 6, 20 and 21. Claims 1 - 23 are currently pending in the application. Accordingly, claims 1 - 23 are submitted for reconsideration.

Applicants thank the examiner for the indication of allowable subject matter in claims 13-15. However, for the reason set forth below, Applicants believe the independent claims 1, 3, 6 and 20 are also in condition for allowance.

The specification stands objected to because the numeral "12" is not mentioned in the specification. Applicants have inserted numeral "12" on page 4 of the specification. Thus, this objection should be withdrawn.

The specification stands objected to because the reference signs "110" and "99" are allegedly not shown in the drawings. Applicants respectfully direct the examiner's attention to Figure 2A wherein reference sign "110" is shown as enclosed in brackets near reference sign "106". Additionally, the specification has been amended to correct a typographical error with respect to reference sign "99" as noted by the examiner. Thus, these objections should also be withdrawn.

Claims 3 - 5 and 21 stand rejected under 35 U.S.C. § 112, second paragraph as being indefinite. Claim 3 has been amended by replacing "surface" for the word "portion" to correct a typographical error. Claim 21 has also been amended to provide proper antecedent basis for the claim. Thus, the 35 U.S.C. § 112 rejections have been overcome and should be withdrawn.

In the Office Action, claims 1 - 9, 16 - 23 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Wieczorek* '959 in view of *Daly* '254. Claims 6-11 are rejected under 35 U.S.C. § 103(a) as being unpatentable over *Wieczorek* '959 in view of *Horsting* '384. Claim 12 is rejected under 35 U.S.C. § 103(a) as being unpatentable over *Wieczorek* '959 in view of *Horsting* '384 and further in view of *Renowden et al.*, '812.

Applicants respectfully traverse these rejections, insofar as they may be applied to the claims as amended.

Claims 1, 6 and 20 have been amended to recite features not shown in the relied prior art. In particular, the claims have been amended to recite that the claimed seat protrudes from the claimed body of the fuel injector. Support for this amendment can be found in the originally filed specification, for example, in Figures 1, 2A and 2B, which show a seat 108 protruding from the body 66 of the fuel injector 10.

In contrast to the claimed invention as a whole, *Wieczorek* '959 discloses a seat 14 disposed within the body 10 of the fuel injector. The seat 14 is retained in the body by a retainer that is also disposed within the body. The seat and retainer are disposed within the fuel injector such that nothing protrudes from the body portion of the fuel injector. Furthermore, none of the remaining references (*Daly* '254, *Horsting* '384 or *Renowden et al.*, '812) cures the deficiencies of *Wieczorek* '959 because each of the remaining references teaches that the seat and retainer of each reference must also be disposed within a fuel injector. Thus, Applicants respectfully request that the rejections to claims 1, 6 and 20 under 35 U.S.C. § 103(a) be withdrawn. Accordingly, claims 1, 6 and 20 are now in condition for allowance.

Each of remaining claims 2 - 5, 7 - 19 and 21 - 23, as depending ultimately from independent claims 1, 6 and 20, are therefore also allowable for at least the same reasons as claims 1, 6 and 20.

Applicants acknowledge the prior art references cited but not relied upon in the Office Action. However, none of the references cited, *Pielstick* '904, *Gaupp* '653 or *Tanasawa et al.*, '746, either alone or in combination, discloses all claim limitations of claims 1-23.

In conclusion, the prior art does not teach or suggest Applicant's novel and unobvious invention as recited in the claims. Thus, in view of the foregoing amendments and remarks, Applicant respectfully requests reconsideration of the application and timely allowance of the pending claims 1-23.

The Examiner is invited to contact the undersigned by telephone if any issues remain unresolved.

EXCEPT for issue fees payable under 37 C.F.R. § 1.18, the Commissioner is hereby authorized by this paper to charge any additional fees during the entire pendency of this application including fees due under 37 C.F.R. §§ 1.16 and 1.17 which may be required, including any required extension of time fees, or credit any overpayment to Deposit Account 50-0310. This paragraph is intended to be a Constructive Petition for Time in accordance with 37 C.F.R. § 1.136(a)(3).

Attached hereto is a marked-up version of the changes made to the claims and the specification by the current amendment. The attached pages are captioned: "Version with Markings to Show Changes Made."

Respectfully submitted,
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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

Claim 1 has been amended as follows:

1. A fuel injector having a fuel inlet, a fuel outlet, and a fuel passageway extending from the fuel inlet to the fuel outlet along a longitudinal axis, the fuel injector comprising:

a body having an inlet portion, an outlet portion, a neck portion disposed between the inlet portion and the outlet portion, the neck portion including a cylindrical annulus that provides a body passage extending from the inlet portion to the outlet portion along the longitudinal axis of the fuel injector;

an armature proximate the inlet portion of the body;

a cylindrical needle operatively connected to the armature;

a seat ~~[disposed at]~~ protruding from the outlet portion of the body; and

a swirl generator proximate the seat;

wherein the cylindrical annulus of the body includes an inner diameter that is greater than a diameter of the cylindrical needle so as to define the body passage, which maintains an operative relationship between the body and the needle.

Claim 3 has been amended as follows:

3. The fuel injector of claim 1, wherein the seat comprises a first surface exposed to the fuel passageway and a second surface exposed to an exterior of the fuel injector, the first surface being spaced from the second surface a defined distance along the longitudinal axis, the first ~~[portion]~~ surface having at least one cut-out configuration that extends for a fraction of the defined distance into an interior of seat.

Claim 6 has been amended as follows:

6. A fuel injector having a fuel inlet, a fuel outlet, and a fuel passageway extending from the fuel inlet to the fuel outlet along a longitudinal axis, the fuel injector comprising:

a body having an inlet portion, an outlet portion, and a body passage extending from the inlet portion to the outlet portion along the longitudinal axis;

an armature proximate the inlet portion of the body;

a needle operatively connected to the armature;

a swirl generator proximate the needle;

a seat ~~[disposed at]~~ protruding from the outlet portion of said body, the seat including a first surface exposed to the body passage and a second surface exposed to an exterior of the fuel injector, the first surface being spaced from the second surface a defined distance along the longitudinal axis, the first portion having at least one cut-out configuration that extends from the first surface for a fraction of the defined distance into an interior of seat.

Claim 20 has been amended as follows:

20. A method of stabilizing temperature of a fuel injector in a direct injection application, the fuel injector having a body; an armature proximate an inlet of the body; a needle operatively connected to the armature; a seat ~~[disposed at the outlet of]~~ protruding from the body; and a swirl generator proximate the seat, the method comprising:

providing the needle with a substantially uniform cross-sectional area; and

selecting the body to surround the needle and form a body passage, the body passage maintains an operative relationship between the body and the needle;

wherein fuel in the body passage transfers heat from the body to the needle to maintain a minimum temperature gradient and to maintain an operative relationship between the body and the needle.

Claim 21 has been amended as follows:

21. The method of claim 20, wherein ~~the~~ an average cross-sectional area of the body passage is less than 2.25 times the substantially uniform cross-sectional area of the needle.

IN THE SPECIFICATION:

The paragraph beginning on page 4, line 7 has been amended as follows:

Fig.1 illustrates a preferred embodiment of the fuel injector 10, in particular a high-pressure, direct-injection fuel injector 10. The fuel injector 10 has a housing, which includes a fuel inlet 12, a fuel outlet 14, and a fuel passageway 16 extending from the fuel inlet to the fuel outlet 14 along a longitudinal axis 18. The housing includes an overmolded plastic member 20 cincturing a metallic support member 22.

The paragraph beginning on page 7, line 7 has been amended as follows:

As shown in ~~{Fig. 1}~~ Figures 2A and 3A, the first surface 102 of the seat 64 is directed toward the body passage 58 of the body 52 and a second surface 104 of the seat 64 is exposed to an exterior of the fuel injector 10. The first surface 102 is spaced from the second surface 104 a defined distance along the longitudinal axis 18 of the fuel injector 10. As shown in Figs. ~~{2A}~~ 2B and ~~{3A}~~ 3B, the first surface 102, in an alternative embodiment of the seat 64, has at least one cut-out 106 that extends from the first surface 102 for a fraction of the defined distance into an interior of the seat 108. Preferably, the at least one cut-out 106 comprises at least one volume 110 that defines at least one wall 122 in the interior of the seat 108.

The paragraph beginning on page 7, line 15, has been amended as follows:

The at least one volume 110 within the interior of the body 52 allows for fuel to enter the interior of the seat 108. Because, during operation, the fuel within the fuel injector 10 is typically at a lower temperature than the temperature of the seat 64, the fuel tends to assist in stabilizing the temperature of the components of the fuel injector 10 within the engine cylinder. In particular, the at least one volume 110 allows for the fuel in the fuel passage of the fuel injector 10 to reduce the operative temperature of the seat 64. Lower operative temperatures of the seat 64 are believed to reduce coking of fuel on the second surface 104 of the seat 64.

The paragraph beginning on page 7, line 23, has been amended as follows:

In a first preferred embodiment, the at least one volume 110 is a plurality of volumes 110P arranged in the first surface 102 to correspond to the plurality of fuel passage openings 94 of the guide disk 86. As illustrated in Fig. 2A, each of the plurality of volumes 110P is, preferably, a cylindrical volume 114 having a first diameter 116, and each of the plurality of fuel

passage openings ~~{99}~~ 94 is, preferably, a circular aperture 118 having a second diameter 120. The first diameter 116 of the cylindrical volume 114 is substantially equal to the second diameter 120 of the fuel passage opening in order to maximize fuel flow efficiency.

The paragraph beginning on page 8, line 8 has been amended as follows:

In a second preferred alternative embodiment, the at least one volume 110 is a channel 126 arranged in the first surface 102 to correspond to the plurality of fuel passage openings 94. The channel 126 has a width 128 on the first surface 102, and each of the plurality of fuel passage openings 94 is, preferably, a circular aperture 118 with a diameter 130. The diameter 130 of one of the fuel passage openings 94 is substantially equal to the width 128 of the channel 126. The channel 126 is, preferably, a continuous channel 126, such as the circular channel illustrated in Fig. ~~{3}~~ 3B. The continuous channel 126 defines an inner side wall 132, an outer side wall 134, and a channel end wall 136. The channel end wall 136 engages both the inner side wall 132 and the outer side wall 134.
